The digital version of the Geologic Map of the Bent Creek Experimental Forest

Abstract

This document supplements the digital version of the Geologic Map of the Bent Creek Experimental Forest by providing brief information on map production methods and complete descriptions of the rock classification and mapping units.

PRODUCTION OF THE DIGITAL MAP

This digital version is based on a conventional bedrock geologic map prepared by the N.C. Geological Survey:

Merschat, C.E.; Carter, M.W. 2002. Bedrock geologic map of the Bent Creek Research and Demonstration Forest, Southern Research Station, USDA Forest Service, including the North Carolina Arboretum and a portion of the Blue Ridge Parkway: North Carolina Geological Survey Geologic Map Series-9, scale 1:12,000.

Conventional geologic mapping was made on a 1:12,000 topographic base map prepared from aerial photography made in April 1996. Field mapping was done from November 1998 through March 1999 through a cooperative agreement with geologists of the Asheville field office of the N.C. Geological Survey. The geologists used conventional methods for field mapping that involved walking ridges, slopes, and streams to examine outcrops of bedrock. Particular emphasis was given to small units of amphibolite rocks. The conventional map presents additional information on structural features, whole rock analyses, heavy minerals, and analysis of selected amphibolite samples.

The digital version of the Bent Creek Experimental Geologic Map was prepared from ArcView (a software product of ESRI Inc.) shape files of rock unit polygons produced by the NC Geological Survey during preparation of the conventional map. The shape files, however, could not be properly georeferenced for geographic information system application without distortion. The polygon shape files and state plane tic marks were printed and electronically scanned as a high resolution image. The scanned image was displayed on a computer screen and using geographic information system software, each rock unit polygon was digitized using the NC State Plane coordinate system, NAD 1927, with units of feet.

This digital version of the geologic map was produced in early 2004. Several small errors are recognized, consisting mainly of sliver polygons. These and other errors will be corrected in the next version. The descriptions of map classification units were taken from the 2002 conventional map produced by the N.C. Geological Survey, referenced above.

Map classification units

Rock units of the Bent Creek Experimental Forest are components of the Ashe Metamorphic Suite, which is prevalent in the southern Appalachian Mountains of western North Carolina.

ASHE METAMORPHIC SUITE:

The Ashe Metamorphic Suite is a heterogeneous unit consisting of repetitive layers and lenses of sedimentary and mafic volcanic rocks metamorphosed to sillimanite grade. It is subdivided and mapped based on dominant rock type into five lithologic units:

Sillimanite-Garnet-Chlorite-Mica-Metasiltstone (Zasi): Medium-gray to dark-gray; strongly foliated; fine- to medium-grained; equigranular to inequigranular, lepidoblastic to weakly granoblastic to porphyroblastic; locally migmatitic; consists of 3.6-21.4% quartz, 0.4-17.2% plagioclase, 37.6-71.0% muscovite, 10.6-15.8% chlorite, 5.6-10.0% garnet, 3.0-3.6% ilmenite and other black opaque minerals, 0.0-0.2% epidote group minerals, and a trace of sillimanite; thickness of layering ranges from several millimeters to several centimeters; commonly interlayered with metagraywacke and sillimanite-garnet-chlorite-mica schist

Metagraywacke (Zag): Medium-light gray to medium-dark gray; non-foliated to weakly foliated; medium- to coarse grained; equigranular to inequigranular; granoblastic to lepidoblastic; locally migmatitic; consists of 26.4-37.2% quartz, 31.8-42.2% plagioclase, 0.0-28.4% k-feldspar, 3.8-8.0% muscovite, 6.0-11.4% biotite, 0.6-2.0% garnet, 0.0-1.0% hornblende, trace-10.8% epidote group minerals, trace- 0.6% ilmenite and other black opaque minerals, trace-0.4% apatite, and a trace of zircon; thickness of layering ranges from several decimeters to several meters.

Metaconglomerate (Zac): Medium-light gray to medium-dark gray; non-foliated to weakly foliated; coarse grained (most commonly granule size); inequigranular; granoblastic; consists of 62.6 - 66.2% quartz, 6.4-16.8% plagioclase, 0.0-4.4% k-feldpar, 6.8-16.6% biotite, 5.4-13.0% muscovite, 0.2-0.8% ilmenite and other black opaque minerals, 0.0-0.4% epidote group minerals,, 0.0-0.2% garnet, 0.0-0.2% apatite, and a trace of zircon; thickness of layering ranges from decimeters to meters; granule composition is dominantly quartz, commonly interlayered with metagraywacke, but also occurs locally as very thin interlayers in sillimanite-garnet-chlorite-mica-metasiltstone. Many metaconglomerate layers are difficult to recognize because of migmatization and metamorphic recrystallization.

Amphibolite (Zaa): Two textural varieties of amphibolite occur in the Bent Creek Research and Demonstration Forest, but can not be mapped separately into distinct map units. One is dark-green to black, equigranular, fine- to medium-grained, strongly foliated, and nematoblastic. The other is dark-gray to dark-greenish-gray, equigranular to inequigranular, medium- to coarse-grained, non-foliated, and granoblastic to porphyroblastic. Thickness of layering in both varieties ranges from centimeters to meters. Collectively, both consist of 32.2-76.2% hornblende, trace-38.1% plagioclase, 0.0-7.6% quartz, 0.0-3.0% garnet, 0.0-6.6% chlorite, 0.0-11.2% ilmenite and other black opaque minerals, 0.0-1.2% apatite, 0.0-8.2% biotite, 0.0-27.4% epidote group minerals, 0.0-10.0% actinolite and tremolite, 0.0-6.8% diopside and other clinopyroxenes, 0.0%-trace myrmekite, 0.0-7.4% sphene, 0.0%-trace tourmaline, 0.0-2.0% rutile, 0.0-1.4% sericite, 0.0-0.4% zircon, and 0.0-0.6% k-feldspar. One sample of chlorite-actinolite/tremolite schist (map number ts-791U) consists of 56.4% actinolite and tremolite, 38.6% chlorite, 3.2% quartz, 1.2% rutile, 0.6% sphene, and traces of diopside and other clinopyroxenes, epidote group minerals, and biotite. Thinner layers and lenses of amphibolite, too small and discontinuous to be shown at this scale, are

interlayered with other rock types in all map units.

Sillimanite-Garnet-Chlorite-Mica Schist (Zas): Very light-gray to greenish-gray to medium-gray; strongly foliated; fine-grained; equigranular to inequigranular; lepidoblastic to porphyroblastic; consists of 0.6-13.6% quartz, 0.0-0.6% plagioclase, 31.6-74.4% muscovite, 0.018.0% sericite, 6.2-15.2% chlorite, 0.2-25.6% garnet, 3.0-7.8% opaques, and a trace of sillimanite; thickness of layering ranges from millimeters to centimeters; commonly interlayered with sillimanite-garnet-chlorite-mica metasiltstone.

The following rock types also occur in the Bent Creek Research and Demonstration Forest, but individual bodies are too small and discontinuous to be shown at this scale.

PALEOZOIC INTRUSIVES

Trondhjemite: Very light-gray to yellowish-gray; typically non-foliated; fine- to medium-grained, equigranular to inequigranular; typically granoblastic to megacrystic; occur as thin dikes and sills ranging in thickness from centimeters to meters. Although most trondhjamites are typically potassium-poor, one dike (map number ts-686) analyzed consists of 61.0% plagioclase feldspar, 24.8% quartz, 12.6% muscovite, 1.2% epidote group minerals, and a trace of garnet (composition indicative of a muscovite-rich tonalite).

Pegmatite: White to very light-gray, mottled; non-foliated; very coarse-grained, equigranular; granoblastic. Bodies are lenticular to tabular. Thickness of bodies ranges from decimeters to meters. Pegmatite consists primarily of plagioclase and microcline feldspars, quartz, muscovite and, less common, biotite and garnet. Pegmatites typically cross-cut layering and foliation of other rock units. The absence of large igneous intrusive bodies in this area as a source for pegmatitic material suggests that these pegmatites were probably derived from local melting during regional high-grade metamorphism.

METAMORPHIC ROCKS

Migmatite: White to very light-gray, non-foliated to weakly foliated medium- to coarse-grained; equigranular; granoblastie, occurs as generally thin layers and lenses (thickness of layering ranges from centimeters to decimeters) within other rock types (most commonly metagraywacke), and is locally gradational with pegmatite. One sample (map number ts-662) analyzed consists of 31.8% plagioclase feldspar, 28.4% k-feldspar, 26.4% quartz, 7.4% muscovite and sericite, and 6.0% biotite. Migmatites in this region were most likely derived from local melting during regional high-grade metamorphism.

Calc-Silicate Granofels: Light-gray to medium-gray; weakly to strongly foliated; fine-to medium-grained, equigranular; granoblastic to porphyroblastic; typically consists of quartz, plagioclase, a mafic mineral (either an amphibole or biotite) and garnet, occurs in all metasedimentary rock types as thin layers, lenses, and pods less than one meter thick, and is also associated and possibly gradational with amphibolite.